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St. Lawrence Power

Key to the Fuel Crisis on the Eastern Seaboard

Address by Hon. Alexander T. Vogelsang
First Assistant and Acting Secretary of the Interior
National Rivers and Harbors Congress
Washington, December 10, 1919

Power is running to waste in the St. Lawrence River—millions of horsepower.

In the International Section, three times the power developed at Niagara—running to waste while industries are scrambling for fuel, railroads are struggling with their load, resources are depleted.

Utilize this power and all the public utilities within 250 miles may be served by it. Enough left over to make the St. Lawrence Valley a hive of industry. Enough still left over for transmission through Central New York, perhaps through New England, possibly to the Metropolitan district.

This power will be set to work when and as the St. Lawrence is improved for navigation—OPEN THE LOCKS.

OPEN THE LOCKS

St. Lawrence Power

The Loosing of Creative Energy for the Nation's Workshop by the Same Improvement Which Extends the Seaway to the Great West.

By ALEXANDER T. VOGELSANG,
First Assistant Secretary of the Interior.

Gentlemen of the Rivers and Harbors Congress:

I have been asked to make a brief address upon the question of hydro-electric power that may be developed along that part of the St. Lawrence River constituting the boundary between the United States and Canada in connection with a proposed waterway which will accommodate ocean borne vessels.

The advocates of this enterprise are chiefly resident far west of the St. Lawrence River, and the power feature of the work is only of incidental or general interest to them in their promotion of the navigation project, but to the State of New York and portions of New England it is a matter of extreme importance.

The Department of the Interior is charged with the administration and control of publicly owned hydro-electric power sites and has, therefore, ever kept itself abreast of the development of the art wheresoever that development may have taken place, and in the beginning I wish to give due and full credit for assistance in the preparation of this paper to the magnificent annual report of the Secretary of the Interior, just issued, and to the Geological Survey and the Bureau of Mines. Through the agencies of these bureaus the Department is in daily touch with the power question, and out of its abundant researches and statistics I am enabled to present in outline some views which may create at least a conception in the average mind of the prime importance of power in our economic fabric. It is, indeed, the first among the present-day problems of science.

The development of this waterway with incidental power production is a work that appeals to our constructive imagination. It appeals to true statesmanship as defined by Jonathan Swift two hundred years ago, when he said in the Voyage to Brobdingnag:

> And he gave it for his opinion that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before would deserve better of mankind and do more essential service to his country, than the whole race of politicians put together.

I may add at this point that more than a million men are now engaged in producing mineral fuels, the consumption of which expends and exhausts the stores of nature. On the other hand, the white coal of falling water is exhaustless, is everlasting. Any project that will lower transportation costs and at the same time

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yield energy for the use of man conforms to modern economic thought.

There is a growing tendency to redistribute those industries of the country which require large amounts of power to locations where water power is abundant and cheap. Thus, water power will control the location of those industries in which the cost of power is a large item in the value of the product.

Dr. Steinmetz estimates the theoretical maximum of hydro-electric power of the United States at 320,000,000 horsepower, though of course but a fraction thereof can be made practically available. The Geological Survey estimates the amount practically available to be 54,000,000 continuous horsepower, and of this the boundary waters in question can produce nearly 2,000,000 horsepower, half of which belongs to us.

The Census of 1912 shows the developed water power of the United States was 4,870,000 horsepower. According to that census, the installed capacity of stationary prime movers was 30,000,000 horsepower, furnished by water, gas, and steam. This does not include power generated in locomotives, marine engines, automobiles, and such apparatus. The average power furnished by these prime movers was probably not more than 20 per cent of installed capacity, so that power produced in 1912 was probably not more than 6,000,000 continuous horsepower.

Seventy per cent of the waterpower is west of the Mississippi, and over 70 per cent of stationary prime-movers horsepower is east of that river. **Thus it is seen that the East is rapidly consuming the expendable resources of power, and that if she continues to sleep upon her water power possibilities she may soon see the transfer of many of her great industries to the enterprising, forceful, and ever-alert West.**

An Incomparable Resource.

St. Lawrence River from Tibbets Point, at the foot of Lake Ontario, to deep water at the level of Lake St. Francis at St. Regis, N. Y., flows about 113 miles along the international boundary and has a fall at low water of about 92 feet, of which about 91 feet is in the lower 48 miles, from Galop Rapids to St. Regis, there being a fall of but one foot in the 65 miles from Lake Ontario to Galop Rapids. The fall in the lower section of the river is concentrated in a number of rapids which are passed by means of canals and locks on the Canadian side. The Long Sault Rapids, with a fall of 48 feet, extend for about 12 miles along the lower end of this section.

From St. Regis to ocean navigation at Montreal there is a fall of about 130 feet in a distance of about 70 miles, of which 129 feet is concentrated in two stretches of 14 and 8½ miles, the former

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including Coteau, Cedar, and Cascade rapids, in which the fall is 84 feet, and the latter, including Lachine Rapids, in which the fall is 45 feet.

It is only necessary to consider the immense amount of water flowing in the St. Lawrence River and its uniformity of flow to realize the tremendous amount of water power capable of being developed along the international portion of the river. The mean annual flow at the head of the river, as shown by records obtained from 1860 to 1917, is 241,000 second-feet. The effect of the Great Lakes, which act as a great system of storage reservoirs in regulating the flow in the St. Lawrence, is indicated by the fact that the maximum and minimum flow of the river differ by only about 25 per cent from its mean flow. A comparison of this ratio with similar ratios for the Ohio and Mississippi rivers indicates that the flow of the St. Lawrence is remarkably uniform. The mean flow of the Ohio River at its mouth is about 300,000 second-feet, its maximum flow is about three times the mean, and its minimum flow is about one-tenth the mean. The mean flow of the Mississippi at the power plant of the Mississippi River Power Company at Keokuk is about 50,000 second-feet. The maximum is about six times the mean and the minimum is about one-fifth the mean.

The amount of theoretical power per foot of fall in the St. Lawrence River, as shown by the mean annual flow, is 27,360 horsepower, and as a total fall of 92 feet is available in the international section of the river the theoretical power in that section is about 2,520,000 horsepower. Assuming that only 70 per cent of this energy can be made available on account of losses in head and inefficiencies of water wheels and generating equipment, this stretch of the river, owned equally by the United States and Canada, would furnish 1,764,000 horsepower, or 882,000 horsepower to each. About 95,000 horsepower of the portion belonging to the United States has already been developed by the St. Lawrence River Power Company by means of a canal which diverts a maximum of 30,000 second-feet from the river near the head of the Long Sault Rapids through the power house into Grass River, which joins the St. Lawrence below the Long Sault Rapids. Here a head of about 40 feet is developed. After the power utilized at this development is deducted from the power of the portion belonging to the United States, the power not yet developed in that portion of the river amounts to about 790,000 horsepower.

As a horsepower is practically three-fourths of a kilowatt, 790,000 horsepower is equivalent to about 590,000 kilowatts. This amount of power is about one-third the total installed generating capacity of all the plants engaged in producing electricity for public use in New York State, slightly more than the installed capacity of generators of similar plants in the State of Michigan,

and about 75 per cent of the capacity of those in Massachusetts. In only six States in the United States does the total installed capacity of electric generators in public utility plants exceed 590,000 kilowatts.

This power may be used near the points of development by industries in which power is a large component of the product or it may be transmitted as a public service supply to power markets that are now dependent on fuels. Doubtless neither of these courses should be followed to the complete exclusion of the other, but it is worth while to examine somewhat the conditions of public power supply within transmission distance of these sites in order to see what are the possibilities of absorbing so large an amount of power.

If the development were so made that a certain amount of regulation of stream flow by storage in Lake Ontario were possible and if load conditions were adapted to the full utilization of all the power produced, it would appear that the share of the United States of the St. Lawrence River power would be about 425,000,000 kilowatt-hours per month. The amount of power produced from fuels in public utility plants during the month of February, 1919, in New England and New York State was about 460,000,000 kilowatt-hours. The amount of power so produced from fuels during that month in the central New York region, from Albany to Buffalo, was only about 30,000,000 kilowatt-hours, so that if any considerable portion of the St. Lawrence River power were to be marketed for use by public utilities it would have to be transmitted to the metropolitan district of New York, a distance of about 350 miles. Here there is now produced from fuel at least 300,000,000 kilowatt-hours per month. Much of New England is within a transmission distance of 250 miles and requires about 150,000,000 kilowatt-hours of fuel-produced energy monthly for public service alone. The industrial plants not supplied by public service companies use a large additional but unknown quantity of energy. The transmission of these quantities of power over the distances indicated is unprecedented but is not to be regarded as unattainable in the present state of high-tension operation. In view of these requirements, **there can be no reasonable doubt in anyone's mind that there would be an ample market for all the power that can be developed on the St. Lawrence.** The annual value of our horsepower would be about $12,000,000, and figured on a five per cent basis would show a capital value of $240,000,000.

The utilization of this power in public service to replace coal now consumed in the large manufacturing centers of New York and New England has an important bearing on the extension of the life of our coal deposits. On the basis of three pounds of coal per kilowatt-hour, this St. Lawrence River power is the equivalent of

about 7,750,000 tons of coal annually. This is about 1.3 per cent of the total production of bituminous coal in the United States in 1918. The amount of coal consumed per year by public utility plants in New England and New York is only about 7,000,000 tons.

If, on the other hand, the demand for electro-chemical and other products requiring large quantities of power, increases, these water powers will give opportunity for greatly enlarged industrial development. Doubtless most of the power developed on the Canadian side, not only in the boundary portion of the river, but in the purely Canadian portion below, would be utilized for such purposes. **This portion is within easy reach of the largest commercial centers, and after the St. Lawrence has been made more fully available for navigation it would be possible for ocean shipping to reach the factory sites.** Assuming, as seems entirely probable, that these developments are made at low cost and can deliver power at attractive rates, it is entirely unlikely that this power can be marketed as rapidly as it can be developed.

Under normal conditions, the railroads, especially those in the northeastern part of the United States, are overburdened with coal. From 35 to 40 per cent of their cargo space is given up to the transportation of coal. The full utilization of the water powers of the St. Lawrence would reduce greatly the tonnage of coal to be moved into New York and the New England States.

The saving in man power by producing energy by water power, as compared with steam power, is large, especially if the number of miners required to provide coal is considered. A large southern power company shows, by comparing the number of men needed to operate one of its hydro-electric plants on the Coosa River with the number, including the miners, needed to operate one of its steam plants, that in a water power plant one man is required per 5,250 kilowatts of capacity, whereas in a steam plant one man is required per 74 kilowatts of capacity.

Applying these figures to the water power available on the St. Lawrence and assuming that the 590,000 kilowatts of water power would replace the same amount of steam power, about 7,900 men would be released for work in other fields.

The power possibilities of the St. Lawrence have therefore very large economic importance, and any plans for developing the river for navigation should make provision for the maximum development of the energy that it will afford. This provision can be made only by working out a comprehensive plan in which both Canada and the United States seek the best engineering and economic solution of the problem. **No doubt private capital is available to make all this improvement in consideration of a grant of the power privilege, but there is equally no doubt that this will not be done. Canada as well as the United States would not permit it.**

The availability of the water power of the St. Lawrence should also receive the most careful consideration if Congress authorizes Secretary Lane's plan for a power survey of the North Atlantic industrial region.

It is now three years since Congress was urged to authorize a study of the power possibilities of the congested industrial part of the Atlantic seaboard with a view to disclosing not only the fact that a great saving in power could be effected and a much larger actual use of the power now produced could be gained but that new supplies could be obtained both from running water and from the conversion of coal into power at the mines instead of after a long haul. The feasibility of constructing a super-transmission line of electric power paralleling the Atlantic from Richmond to Boston, affording connections at New York and Boston with the vast water-power resources of the St. Lawrence on the north and Niagara on the west, a main transmission line into which would run many minor feeding streams of power and from which would diverge an infinite number of small delivering lines tying together the separated power plants of ten States, so that one could give aid to the other, so that one could take the place of the other, so that all may join their power for good in any great drive that may be projected, may well be investigated by the Government, not with the thought that the Government would construct or even operate such a trunk line, but that the project might so attract the attention of the engineering and financial world as to make it a reality.

Such a system of transmission lines would take from the coal mine and the railroads much of their burden and insure the operation of street lights, street cars, and essential industries in the face of railroad delinquencies.

The demand for power for the use of industrial and public utilities in New England and New York is increasing. Winter conditions like those of 1917-1918 would again cause, and to a greater degree, the same difficulty that then occurred in supplying coal to the country's essential industries. **The water power of the St. Lawrence would furnish sufficient energy to supply a large part of the power now generated by fuel in the northeastern part of this dominant industrial district of the United States.** The demand for power in this district would undoubtedly consume all that portion of the St. Lawrence power that belongs to the United States and all of that portion of Canada's share for which there was no demand in that country.

The power production will pay the entire cost of all the work. As I understand it, our neighbor proposes to go into the enterprise on a fifty-fifty basis in spite of the apparent fact that the present advantage is enormously in our favor. Shall Canada's seven mil-

lion people say "I will," and Uncle Sam's one hundred and ten million say "I won't"? Or, shall we rather cooperate and develop this waterway, obtaining thereby, practically as a by-product, this tremendous resource of power?

A Word About Coal.

About 55 per cent of the world's coal is in the United States. **We must some day become great as a coal exporting nation.** In the pre-war period we sold abroad only 4,500,000 tons of our annual production of 700,000,000 tons, which Secretary Lane visualizes in his report by stating that this amount of coal would build a Chinese wall along the outboundaries of the United States from Maine to Vancouver, to San Diego, and eastward to Maine again. England exported 77,000,000 tons. In fact, England's primacy in commerce is due to her coal exports, which afforded cargo to her merchant fleet and gave her bunkering facilities all over the globe.

She can no longer maintain this figure of exportation for many reasons, and is even now asking us for coal. Continental Europe freezes to-day, and will probably henceforth be forced to large purchases from us. Indeed, her prayers to us to-day are as fervent for fuel as they are for food and credit. We must also henceforth largely supply the South American market. **It is easily imaginable that clearing this waterway to navigation will release for export millions of tons of coal from the central fields and thus stabilize labor and general mining conditions,** giving to the mine-worker what to-day he craves most—more days of work per year—with necessarily resulting benefit to the mine owner and operator as well.

The railroads, indeed, should be relieved as much as possible of the carriage of coal. It is the largest single item of railroad freight. Hydro-electric power and power generated by coal at the mouth of the mine will in no distant day not only avoid the great haulage of this low-grade freight, but will propel the trains themselves which will carry the high-value product of looms and factories that also are driven by electric power. We may indulge the high conception that one day this great coal-producing nation will operate her mills, her mines, her railroads, by electric power and ship a vast mass of her coal production by water route almost from mine to foreign market.

The value and importance of water transportation will be discussed by others, but I venture this question: **Where would our iron industry be to-day were it not for the cheap water transportation enjoyed by four-fifths of our total iron ore production tributary to the Great Lakes? That waterway and not that iron is the foundation of our position as the world's greatest producer of iron and steel.** This is a fair illustration of the claims made by the proponents of this improvement, that transportation governs production. Indeed, obstructions to navigation are obstructions to commerce and obstructions to production. The removal of the first enhances the others. High cost of freight rates promotes high cost of living and puts production on the "red," and when production goes upon the red it is evidence that it has bled to death.

In his introduction to that most valuable work, recently issued, entitled "The Strategy of Minerals," Secretary Lane observes:

"There is an international right to those things which are essential to life. * * * We are to grow nationally by our generosity internationally. " Dr. Smith, director of the Geological Survey, and editor of this publication, also wisely asserts: "A nation's resources are of largest value if they serve the world." These are truths becoming more and more evident to the American mind as each of these present stressful days passes on. **As never before in the history of the world must we realize that the prosperity and happiness of other countries means the happiness and prosperity of America.**

A real and a sound objection to the construction of this waterway and the incidental production of this power may be found, and no doubt some of merit may be advanced. I do not know what they may be, but no doubt objections of a military or political nature may be advanced. They, I should say, are most insubstantial, are entitled only to passing consideration, and really may be answered in a sentence.

New York the Chief Beneficiary.

Recurring again to the power possibilities of the St. Lawrence, I venture to say that it is readily perceptible to anyone that of all the States bordering or tributary to this waterway the greatest beneficiary of the development will be the great and Empire State of New York. **The letting loose of this flood of power over her territory will cause her to leap to the front as a manufacturing State, and her products so stimulated by cheap power will find market in all the countries of the world.** With her magnificent harbor and the superb advantage of her barge canal affording cheap water transportation thereto, and at the same time enjoying and possessing all the benefits of the St. Lawrence route, hundreds of miles nearer salt water than her Western competitors, her high-value manufactures will have a permanent primacy over any other State of the Union. Indeed, it is no idle dream to picture her barge canal and her lake shore dotted with factories of all kinds in enjoyment of this white coal at low rates in operation 365 days in the year, independent of season, their power coming into the factory on a wire instead of by rail and upon cars, free from labor, climatic, or transportation trouble or interruption. No other State of our Union has the same strategic advantage in power, population, labor supply, and transportation, and these advantages for natural and geographical reasons can probably never be lost; and this notwithstanding that the day is coming when the West will hold most of the black-coal reserves of the country in addition to her everlasting majority of the white-coal supply.

In conclusion, let me say that enlightened selfishness, the truest and highest interest of our country, our duty to all mankind, alike dictate that our back door as well as our front door be opened to ocean borne commerce. This is especially manifest because the by-product of electric energy will more than pay the cost of the job.

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The West—one-third the area and population of the United States—needs the St. Lawrence Waterway as a world outlet.

The East—the seat of industry—needs the St. Lawrence Waterway to serve its inland commerce.

The Atlantic Seaboard—the nation's workshop—needs the power running to waste in the river.

The Railroads—the arteries of trade—need this relief from acute congestion.

The Nation—in the dawn of a new economic era—needs this unemployed servant of its latent resources.

OPEN THE LOCKS